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Driving culture change in Malaysian engineering education through EASTeL

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Abstract

As Malaysian Engineering Education moved towards becoming a signatory member of Washington Accord in 2004, there is a significant requirement for Malaysia to genuinely shift from the traditional 'prescriptive-based' system towards 'outcome-based education"(OBE) system. In making the shift two main issues of concern are i) how to help faculty members transform their courses according to OBE and ii) how to make the process of documentation automated and updated in keeping with the rapid changes being made during the transformation period. An Electronic Assessment System for Tertiary Learning (EASTeL) was developed to help educators cope with change focusing on assessment for students learning. EASTeL was tested in Soil Mechanics subject in the second year Civil Engineering Programme at University of Malaya. EASTel was found to be beneficial on both lecturers and students. The result shows that by taking care of assessment using EASTeL, the change to OBE by 'doing' can be achieved. The features in EASTeL can guide the educators to handle crucial assessment issues leading to constructive alignment. Documentations and updating is made simple through the use of its electronic features thus addressing the quality assurance requirements. The use of rubric and criteria can help educators to develop further their skills in assessment through holistic assessment approach. EASTeL focuses on formative assessment element whereby students are empowered by the feedback feature, thus improving their learning.

Keywords: Electronic Assessment System for Tertiary Learning (EASTeL), Outcome-based Education (OBE), formative assessment.

1. Introduction

The engineering education community in Malaysia was first introduced to outcome-based education system in 2004. It was during the time when Malaysia was putting intense efforts towards obtaining full membership of the Washington Accord. The implication as mentioned in "The Future Engineering Education in Malaysia" produced by Ministry of Higher Education Malaysia (MOHE) in 2006 is the need for a genuine shift from the traditional 'prescriptive-based' system towards 'outcome-based education'(OBE) system.

Between 2004 and 2006, intensive training programmes and workshops initiated by MOHE, Engineering Accreditation Council (EAC) and engineering faculties across the country had been conducted to introduce OBE. While learning the new system, all engineering programmes had to undergo curriculum review where OBE was to be evidenced in the new document. As the essence of OBE is indeed constructive alignment (Biggs, 2003), not

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understanding the extent of how it may be applied into actual practice caused a lot of problems. For engineering faculty members who had very little exposure on educational terms, constructive alignment was barely understood. The usual three column form heading Learning Outcome, Teaching and Learning Activities and Assessment was given to faculty members in the hope that constructive alignment can be exercised. Without understanding the theory behind the needs for the three column form, the whole process of migrating to OBE became known as an exhaustive manual form filling exercise. Due to the lack of understanding of constructive alignment, the OBE document was subjected to rapid change making it difficult to monitor and track changes.

The two main issues recognised were i) how to help faculty members transform their courses according to OBE and ii) how to make the process of documentation automated and updated in keeping with the rapid changes being made during the transformation period. In 2006, it was decided that there was a need for a tool to be developed to address the two main issues. The intention behind the development of Electronic Assessment System for Tertiary Learning (EASTeL) was to help educators cope with change through 'learning by doing'. The main theme of EASTeL is constructive alignment through formative assessment as it is the formative assessment that drives learning and it being the heart of quality in teaching and learning.

The following section describes EASTeL features and how it helped lecturers to cope with the transformation of Malaysian Engineering Education.

2. EASTeL Features

EASTeL is a web-based server client system that may be used as stand alone by an individual lecturer or as web-based by programme/institutional owner. The system comprises of two layers namely lecturer and administrative layers. The reason being in OBE all courses need to align with programme outcome and the matrix-based structure for course and programme assessment as outlined by Felder and Brent (2003) is adopted. The three main fields in EASTeL are the course setting facility, assessment scoring and reporting feedback. The first field was specifically designed to enable lecturers to design courses that satisfy OBE requirements via constructive alignment. While the second field was designed to allow lecturers to systematically handle formative assessment incorporating the need for lecturers to understand and develop assessment rubrics. The third field was meant to drive learning via feedback in pursuit of student learning outcomes having in mind the need to speed up the process via electronic system, hence reducing the workload.

2.1. Field 1 : Course setting facility

The essence of this filed is constructive alignment. To enable lecturers to understand alignment and to actually align assessment and teaching and learning activity to learning outcome (LO), lecturers are put into similar environment as if they are filling in the three column form. Table 1 shows the standard form used in OBE document. For the purpose of alignment, in EASTeL environment, lecturers are made to identify the learning domain and its level using Bloom's taxonomy for each of the course learning outcome. A coding system is used such as C4 for LO containing action verb from cognitive domain belonging to level 4 such as relate. A pop up menu of Bloom's Taxonomy is made available for reference. By having this feature it was hoped that lecturers can be made aware that there are other learning domains; that is affective (A) and psychomotor (P) which was often ignored in the previous system. Once LO is set and coded, lecturers are taken to another step where they have to choose the assessment method (s) for each LO. The common problem in setting assessment method in the manual way, was that lecturers are not guided or reminded of the constructive alignment. This often leads to the choice of an assessment method which does not align with the LO stated which then lead to the issue of validity of the assessment for quality assurance. To overcome this problem, the second set of coding system has been introduced. EASTeL in this field forces the lecturers to choose assessment methods and while choosing the methods, they will also need to choose the scoring rubric that that reflect the LO being assessed. As default rubrics being clustered into three domains (C-A-P) which is made available, lecturers are asked to choose rubric from similar domain as the learning outcome. For example if the LO is C4 , the rubric used to score students for the chosen assessment method

must also belong to cognitive domain such as CO3. Note that CO, AF and PS being use to code the cognitive, affective and psychomotor assessment domains respectively and the numbers are not referring to any level but instead is it just an arbitrary. These features will ensure that constructive alignment is not only applied in choosing assessment methods but is also extended to choosing the marking criteria which was often overlooked. The final document after this field setting resulted in the enhanced three column form (Figure 1) enabling lecturers to audit their assessment plan for validity and enabling accreditors to check for quality assurance at first glance.

Table 1. Manual three column form for Soil Mechanics I subject

Course Outcome (CO)	Delivery	Assessment
Ability to relate definition of soil as in engineering context to problems associated with it within local soil condition	Lectures and coursework	Examination coursework report and interview
Ability to differentiate the different types of soil and their properties for classification purposes using British and / or Unified Soil Classification System.	Lectures and laboratory work	Short test and laboratory work/report
Ability to conduct laboratory tests for determination of soil index and soil compaction.	Demonstration and laboratory work.	Laboratory work/report

Course : KAEA2132 SOIL MECHANIC I

Legends:

LO	-	Learning Outcome Code	AF2	-	INTEREST
LO Desc	-	Learning Outcome Description	CO2	-	ANALYTICAL & CRITICAL
AM	-	Assessment Method	CO1	-	KNOWLEDGE
CO	-	Cognitive	PS4	-	OBSERVATION
AF	-	Affective	PS2	-	DYNAMISM
PS	-	Psychomotor	PS3	-	MANIPULATION

No	Taxonomy Level			Learning Outcome	Assessment Method	University		
	C	A	P			CO	AF	PS
1.	C4	A3		STUDENTS WILL BE ABLE RELATE DEFINITION OF SOIL AS IN ENGINNERING CONTEXT TO PROBLEM ASSOCIATED WITH IT WITHIN LOCAL SOIL CONDITION.	COURSEWORK REPORT COURSEWORK INTERVIEW	CO2 -	- AF2	- PS2
2.	C4			STUDENTS WILL BE ABLE TO DIFFERENTIATE THE DIFFERENT TYPES OF SOIL AND THEIR PROPERTIES FOR CLASSIFICATION PUOPOSES USING BRITISH AND / OR UNIFIED SOIL CLASSIFICATION SYSTEM.	TEST	CO1	-	-
3.			P3	STUDENTS WILL BE ABLE TO CONDUCT LABORATORY TESTS FOR DETERMINATION OF SOIL INDEX, COMPACTION AND HYDRAULIC PROPERTIES.	LABORATORY MT1 LABORATORY MT2	- -	- -	PS3 PS4 PS3 PS4

Figure 1. Screen shot from EASTeL course setting field report

2.2. Field 2 : Assessment scoring

In this field, true practice of formative assessment is encouraged and in any circumstances when continuous assessment or multipoint summative (Bloxham & Boyd, 2007) being adopted, formative assessment features provided by EASTeL may still be used. In any formative assessment, feedback is the key to students learning and as for feedback the idea of 'no student should be left behind' is encouraged. Not to overload lecturers, they need to carefully select one ativity, preferably the strongest one when giving feedback through EASTeL. Lecturers then need to select students or group of students to be assessed. While assessing, lecturers may refer to the rubric chosen for the assessment method and may directly add score in the system when the descriptor fits with the student being assessed. At the same time, lecturers may write a comment in the comment field which serves as feedback to students. The feedback is highly encouraged. The electronic environment is hoped to enable lecturers to score and capture feedback while assessing and not to encourage writing feedback based on lecturers reflective exercise on assessment conducted.

2.3 Field 3: Reporting feedback

Once feedback has been entered into the system, students may get access to their performance and the feedback. To encourage students to be responsible for their learning, EASTeL provides a field where students may feed forward on how they think about their performance and suggest on how it may be improved by responding to the feedback. In a small manageable class size, lecturers may wish to give and document feedback for every assessment activity. This is indeed encouraged as students learning development may be tracked. EASTeL enables feedback to be given and documented formatively, allowing both lecturers and students to track the learning development.

The administrative layer of EASTeL enables changes in OBE documentation and implementation being monitored and controlled to ensure quality. While lecturers are being made to learn and implement OBE at the lecturers' layer, the management and control of OBE system is done at the administrative layer.

3. Experimenting with EASTeL on Soil Mechanics I Subject

ESTeL was fully experimented on second year Civil Engineering students (semester 2 session 2008/2009) in Soil Mechanics I subject. Pre and post achievement test were carried out and students reflective and lecturers logs were kept. Table 2 shows the chosen assessment activities where EASTeL has been experimented. New assessment methods namely direct observation for laboratory work and group interview for coursework delivered through problem-based learning (PBL) have been introduced.

Table 2. Assessment methods and activities assessed using EASTeL (KAEA2132 : Soil Mechanics I, Semester 1 08/09)

Assessment method	**Activity**	**Assessment sub-domain**	**Assessment criteria**
Laboratory Work	MT1: Plasticity Test	PS3 and PS4	observation and manipulation
	MT2: Soil Compaction	PS3 and PS4	observation and manipulation
Coursework (PBL)	Coursework report	CO2	analytical and critical
	Interview	AF2 and PS2	interest and dynamism

3.1 Lecturer experience

While setting course information and planning for assessment, it was noted that the steps in fulfilling EASTel field requires one to understand constructive alignment. In addition, to set up course information, lecturers cannot afford to be exploring the various assessment methods, assessment rubric and criteria and at the same time polishing the art of handling feedback. Before moving into the second field, EASTeL in a way pushes the lecturer into further reading and indirectly getting lecturer into researching on teaching and learning practices. It has been found that EASTeL is not a system ready to be used for information processing nor to store data. The use of EASTeL helps in initiating action research in the area of assessment in particular formative assessment. While going through the assessment processes, it has been found that although assessment has been well planned and looked as if it can satisfy the principle of constructive alignment, the actual assessment process was found to be not really that straight forward. Assessment by direct observation for lab work and group interview using rubrics was found to be very challenging. Experiencing such assessment methods which was never done traditionally has led to a realisation that assessing in actual situation requires assessing skills that need to be acquired over time. Writing and giving feedback in itself was another challenging task in terms of the feedback content, characteristics and documentation of feedback. In summary, experiencing EASTeL has led to self realisation of the need to acquire knowledge and skill to be doing it right. This self-realisation is in itself led to self-empowerment for the lecturer to further research into this area and improving it all the time.

3.2 Students experiences

Students were not sure at the beginning as to how EASTeL will create their new learning experience. Although it was thought that students did not care about the new assessment experience designed for them; this is based on

students log in the e-platform showing low students access to assessment instruction and rubrics, they indeed took the initiative and worked extra hard to perform better when they knew that they were being individually observed. "During lab sessions it is a good opportunity to practice OBE (outcome based education) system, whereby Dr. Aishah observed us and checked on how we conducted the lab method…" - *Reflective log (KAEA06001), "when we been constantly observed and assessed, it make us prepare for every class we attend and it teaches us to be responsible in our learning" – Interview transcribe (KES070013).*

In handling feedback, each student was given a written individual feedback on several occasions. These feedback were distributed in the classroom. It was amazing to find the reaction from students where they were excited to read what was written on their feedback form and individual feedback that was thought to be personal for individuals was shared amongst students. Students were found to exchange their feedback with colleagues which indicated that they are indeed concerned about how they were rated against others. It was also found that feedback do act as catalyst to student self-motivation. "Although feedback may sometimes be painful, it is important to us as it shows that the lecturer do care about us" – Interview *(KES070020)*

In summary, students experience with EASTeL found to be able to encourage deep learning and support constructivism theory - "many students said that although some did not achieved good grade on the subject, they certainly did learn a lot from how the subject being conducted" – personal communication (*President of Civil and Environmental engineering club).*

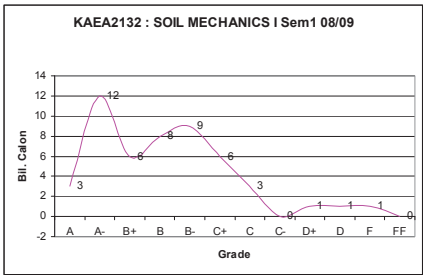
3. Impact on Students Learning

There has been very little increase (from 54.4% to 57%) in the post achievement test in comparison to pre-achievement test conducted. This may be due to the fact that these tests were not counted towards their final grade which may have made students feel less important to go through it and not being serious about it. This was indicated by several students who decided not to participate in the post-achievement test. When comparing achievement of course learning outcome before and after EASTeL intervention. It has been found that EASTeL did improve students learning outcome significantly. An increase of 15% on CO3 and 26% in CO5 were achieved (Table 3). Due to unavoidable constraints, comparison can only be made between different cohorts as control group cannot be found due to the subject been offered only once in every semester with no parallel sessions. Another data that may support the positive outcome of EASTeL intervention on students learning can be seen through the improvement of students overall grade via university grading system. Figure 2 shows the trend on students grades prior to and after EASTeL intervention. It can be seen that the common problem arising when using the criterion-based assessment found as in Semester 1 where results tends to be skewed to the left hand–side of the graph seemed to be taken care of by EASTeL. It was thought that EASTeL to a certain extent although adopting the OBE system, employs holistic approach in assessment, thus reducing the criterion-based effect. Although improvements were found in several aspects after EASTeL intervention, the desired effect and improvement may also contributed by other factors such as the different background of these cohorts, the understanding and readiness of these different cohort towards OBE introduced in Engineering faculty.

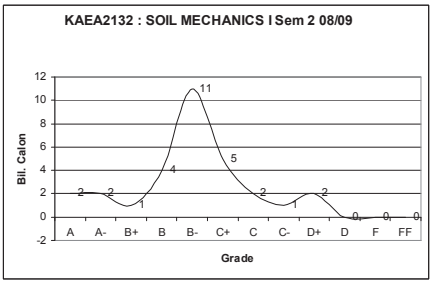
Table 3. Impact of EASTeL on course outcome achievement

		CO Achievement (%)	
Course Outcome (CO)	**Assessment method**	**Semester 1 08/09**	**Semester 2 08.09**
CO1	Examination, coursework report and interview	58.0	56.0
CO2	Short test and laboratory work/report	57.5	74.2
CO3	Laboratory work/report★	70.0	80.8
CO4	Test and final examination	61.0	56.7
CO5	Coursework report and interview★	66.0	83.3

★ With EASTeL intervention



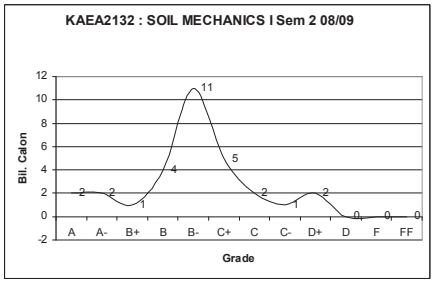
Semester 1 session 2008-2009
(Without EASTeL Intervention)



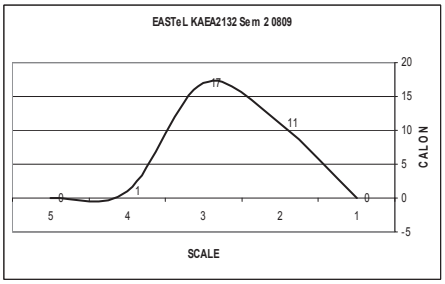
Semester 2 Session 2008-2009
(With EASTeL Intervention)

Figure 2. Overall students grade university grading system

Students overall rating (1 to 5) for their continuous assessment when compared to overall performance has been found to be in agreement . Figure 3 shows how overall students rating using EASTeL from continuous assessment matches with the final grade.



Overall final grade



Continuous assessment average rating using EASTeL

Figure 3. Trend in class performance

4. Future direction

Experiencing EASTeL resulted in one having to change one's practice provided EASTeL use is made compulsory to academicians. However, genuine change should come from the heart wanting to do it. In other words change due to self empowerment which will lead to continual improvement in teaching and learning in higher education. EASTeL's potential in driving change in engineering education may be seen as being the means to drive the first order change (Bloxham & Boyd, 2007) which involves making existing procedures more efficient and effective and speeding up time for return. However, the formative characteristics built in EASTeL and the constructive alignment process, have the potential to drive the second order change (Earl, 2003) which involves change in staff culture (thinking) – taking account transformative approach to thinking about purpose of assessment, enabling staff to comfortably 'accept' and 'embrace' the subjectivity of judgment (Clegg & Bryan, 2006:224) so that they, in part, are liberated to review the contribution of their practice to student learning.

EASTel must go beyond its capability of which expansion into managing course and programme outcome achievement need to be considered. A variety of feedback mechanisms should also be incorporated to allow for speedy feedback approach to be used. Again when considering enhancing EASTeL's feature, many would only tackle the first order change in view of driving culture change. The biggest struggle yet to overcome is to bring about the second order change. Whether it can be done without directive and only with electronic tools is yet to be inquired.

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